JAN 8 1990

594-C-46

FLOOD INSURANCE STUDY

TOWN OF URBANNA, VIRGINIA
MIDDLESEX COUNTY

NOVEMBER 3, 1989

Federal Emergency Management Agency

COMMUNITY NUMBER - 510292

NOTICE TO
FLOOD INSURANCE STUDY USERS

Communities participating in the National Flood Insurance Program (NFIP) have established repositories of flood hazard data for floodplain management and flood insurance purposes. This Flood Insurance Study (FIS) may not contain all data available within the repository. It is advisable to contact the community repository for any additional data.

Part or all of this FIS may be revised and republished at any time. In addition, part of this FIS may be revised by the Letter of Map Revision (LOMR) process, which does not involve republication or redistribution of the FIS. It is, therefore, the responsibility of the user to consult with community officials and to check the community repository to obtain the most current FIS components.

Initial Flood Insurance Study Effective Date: November 3, 1989

Flood Insurance Study Revised:

TABLE OF CONTENTS

		Page
1.0	INTRODUCTION	1
	1.1 Purpose of Study	1
	1.2 Authority and Acknowledgments	1
	1.3 Coordination	1
2.0	AREA STUDIED	2
	2.1 Scope of Study	2
	2.2 Community Description	2
	2.3 Principal Flood Problems	2
	2.4 Flood Protection Measures	5
3.0	ENGINEERING METHODS	5
	3.1 Hydrologic Analyses	6
	3.2 Hydraulic Analyses	8
4.0	FLOODPLAIN MANAGEMENT APPLICATIONS	8
	4.1 Floodplain Boundaries	9
5.0	INSURANCE APPLICATION	9
6.0	FLOOD INSURANCE RATE MAP	10
7.0	OTHER STUDIES	11
8.0	LOCATION OF DATA	11
9.0	BIBLIOGRAPHY AND REFERENCES	11

TABLE OF CONTENTS - continued

Page

FIGURES

Figure 1 - Vicinity Map 3

TABLES

Table 1 - Summary of Stillwater Elevations 8

EXHIBITS

Exhibit 1 - Flood Insurance Rate Map and Street Index

Exhibit 2 - Elevation Reference Marks

FLOOD INSURANCE STUDY
TOWN OF URBANNA, MIDDLESEX COUNTY, VIRGINIA

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study investigates the existence and severity of flood hazards in the Town of Urbanna, Middlesex County, Virginia, and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study has developed flood risk data for various areas of the community that will be used to establish actuarial flood insurance rates and assist the community in their efforts to promote sound floodplain management. Minimum floodplain management requirements for participation in the National Flood Insurance Program (NFIP) are set forth in the Code of Federal Regulations at 44 CFR, 60.3.

In some states or communities, floodplain management criteria or regulations may exist that are more restrictive or comprehensive than the minimum Federal requirements. In such cases, the more restrictive criteria take precedence and the state (or other jurisdictional agency) will be able to explain them.

1.2 Authority and Acknowledgments

The sources of authority for this Flood Insurance Study are the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses for this study were prepared by the Norfolk District of the U. S. Army Corps of Engineers (COE) during the preparation of the Flood Insurance Study for the unincorporated areas of Middlesex County for the Federal Emergency Management Agency (FEMA). The work for that study was completed in March 1987.

1.3 Coordination

On August 28, 1986, the Town of Urbanna was notified by FEMA of the initiation of a Flood Insurance Study for the community. On March 1, 1988, a final Consultation and Coordination Officer's (CCO) meeting was held with representatives of FEMA, the county, the Virginia State Water Control Board, and the Norfolk District of the COE (the study contractor) to review the results of the study.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the incorporated area of the Town of Urbanna, Middlesex County, Virginia. The area of study is shown on the Vicinity Map (Figure 1).

Tidal flooding including its wave action from the Rappahannock River and its adjoining estuaries was studied by detailed methods. The areas studied by detailed methods were selected with priority given to all known flood hazard areas and areas of projected development and proposed construction.

2.2 Community Description

The Town of Urbanna is located on Virginia's Middle Peninsula, a region bordered by the Rappahannock River to the north, the York River to the south, and the Chesapeake Bay to the east. It is completely surrounded by the unincorporated areas of Middlesex County.

The Town of Urbanna is located in the Coastal Plain province and is underlain primarily by sand, gravel, clay, and marl strata. Elevations within the town range from sea level to approximately 35 feet

The Town of Urbanna enjoys a temperate climate with moderate seasonal changes characterized by warm summers and cool winters. Temperatures average approximately 78 degrees Fahrenheit (^{o}F) during July, the warmest month, and 41^{o}F in January, the coolest month. Annual precipitation over the area averages approximately 43 inches (Reference 1). There is some variation in the monthly averages; however, this rainfall is distributed uniformly throughout the year. Snowfall is infrequent, generally occurring in light amounts and usually melting in a short period of time.

2.3 Principal Flood Problems

The coastal areas of Urbanna are vulnerable to tidal flooding from major storms such as hurricanes and northeasters. Both types of storms produce winds that push large volumes of water against the shore.

With their high winds and heavy rainfall, hurricanes are the most severe storms that can hit the study area. The term hurricane is applied to an intense cyclonic storm originating in tropical or subtropical latitudes in the Atlantic Ocean north of the equator. While hurricanes may affect the area from May through November, nearly 80 percent occur in the months of August, September, and October, with approximately 40 percent occurring in September. The most severe hurricane to strike the county occurred in August 1933.

FIGURE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF URBANNA, VA

(MIDDLESEX CO.)

APPROXIMATE SCALE

8 0 8 16 24 MILES

VICINITY MAP

Another type of storm that could cause severe damage to the county is the northeaster. This is also a cyclonic type of storm and originates with little or no warning along the middle and northern Atlantic coast. These storms occur most frequently in the winter months but can occur at any time. Accompanying winds are not of hurricane force but are persistent, causing above-normal tides for long periods of time.

The amount and extent of damage caused by any tidal flood will depend on the topography of the area flooded, the rate of rise of floodwaters, the depth and duration of flooding, the exposure to wave action, and the extent to which structures have been placed in the floodplain. The depth of flooding during these storms depends on the velocity, direction, and duration of the wind; the size and depth of the body of water over which the wind is acting; and the astronomical tide. The duration of flooding depends on the duration of tide-producing forces. Floods caused by hurricanes are usually of much shorter duration than those caused by northeasters. Flooding from hurricanes rarely lasts more than one tidal cycle, while flooding from northeasters can last several days, during which the most severe flooding takes place at the time of the peak astronomical tide.

The timing or coincidence of the maximum storm surge with the normal high tide is an important factor in the consideration of flooding from tidal sources. Tidal waters in the county for the Chesapeake Bay normally fluctuate twice daily from elevation 1.2 feet to minus 1.2 feet. The mean range of tide in the Rappahannock River varies from approximately 1.2 feet at Windmill Point to 1.4 feet at Urbanna to 1.6 feet at Bayport.

Urbanna has experienced major storms since the early settlement of the area. Historical accounts of severe storms in the area date back several hundred years. The following paragraphs discuss some of the larger known floods that have occurred in recent history.

The August 23, 1933, hurricane was the most destructive for this area as well as for the remainder of the Chesapeake Bay region. The hurricane entered the mainland near Cape Hatteras, North Carolina, passed slightly west of Norfolk, and continued in a northern direction accompanied by extreme wind and tide. The storm surge in the Chesapeake Bay and tidal estuaries was the highest of record and coincided with the astronomical tide. The tide at the mouth of the Rappahannock River reached 6.6 feet and 7.0 at Urbanna (Reference 2).

On October 15, 1954, Hurricane Hazel, the second most destructive of recent hurricanes to strike the area, entered the mainland south of Wilmington, North Carolina. The storm moved rapidly northward, passing over Norfolk and Fredericksburg in the early afternoon. The winds were from the east and southeast until the eye passed. During this phase of the storm, damaging tides were experienced along the

western shore of the Chesapeake Bay and the right bank of the Rappahannock River. When the eye passed, the wind shifted to the southwest with higher wind velocities and damages to the left bank. The hurricane surge was not as high as the August 1933 storm, although the tidal surge was superimposed on the normal high tide (Reference 2).

During 1955, two hurricanes affected the Middlesex County area. On August 12-13, 1955, Hurricane Connie followed a path similar to the August 1933 hurricane. The storm generated a fairly high storm surge. The surge occurred at the time of the astronomical low tide in this area, causing only minor damage. On August 17-18, 1955, Hurricane Diane passed inland to the west and did not produce a damaging tide (Reference 2).

In November 1985, high winds and tides combined to play havoc with the Rappahannock River shoreline in the worst storm in decades. The storm was a product of a low pressure system that swept up the Atlantic Seaboard. Northeast winds in excess of 65 miles per hour pushed tides 5 feet above normal and battered piers, bulkheads, boathouses, and other waterfront structures along the Chesapeake Bay and the Rappahannock River.

2.4 Flood Protection Measures

There are no existing flood control structures that would provide protection during major floods in the county. The "Uniform Statewide Building Code" that went into effect in September 1973 states, "where a structure is located in a 100-Year flood plain, the lowest floor of all future construction or substantial improvement to an existing structure..., must be built at or above that level, except for nonresidential structures which may be floodproofed to that level" (Reference 3). These requirements will be beneficial in reducing future flood damage in the county.

3.0 ENGINEERING METHODS

For the flooding source studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude which are expected to be equaled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for floodplain management and for flood insurance rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10, 2, 1, and 0.2 percent chance, respectively, of being equaled or exceeded during any year. Although the recurrence interval represents the long term average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare

flood increases when periods greater than 1 year are considered. For example, the risk of having a flood which equals or exceeds the 100-year flood (1 percent chance of annual exceedence) in any 50-year period is approximately 40 percent (4 in 10), and, for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported herein reflect flooding potentials based on conditions existing in the county at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak elevation-frequency relationships for the flooding source studied in detail affecting the community.

Tide records for Urbanna are inadequate to establish a tide frequency relationship. The adopted tide frequency was obtained by a correlation of the tide frequency curve developed for the Norfolk Harbor gage (located approximately 10 miles inside the Chesapeake Bay) with available tide records and high-water marks at Gloucester Point, Virginia, Lewisetta, Virginia, and Solomon's Island, Maryland. There are historical accounts of tidal flooding for nearly 300 years, but a reasonably accurate indication of the heights reached in Norfolk Harbor is available only since 1908 and a complete record since 1928. The Gloucester Point gage was established in 1950, the Lewisetta gage in 1974, and the Solomon's Island gage in 1937.

The procedure used to develop the frequencies for the Town of Urbanna is as follows:

a. A Norfolk Harbor statistical analysis was performed in accordance with the procedures outlined in Bulletin 17B (Reference 4). The Pearson Type III methodology without the logs was incorporated for the selected period of record from 1928 through 1978. The Pearson Type III distribution without the logs was selected as a result of the following:

   (1) A number of different distributions were fitted to tidal elevation data. The Pearson Type III distribution without the logs provided the best fit of the data points.

   (2) It was felt that a statistical analysis would produce a more reliable and reproducible result when compared to a graphical approach.

b. Consideration was given to separating hurricane and non-hurricane events. Although objective statistical approaches are available for incomplete samples (a hurricane related tide exists for less than 50 percent of the years on record), they do not always provide reasonable results. Therefore, all tropical and extratropical events were included together in the analysis of the annual maximum tides.

c. The analysis of the 51 years of systematic record indicated that the 1933 and 1936 floods could be high outliers. However, assuming that the true distribution is defined by the computed (non-adjusted) statistics, the value for the 1933 flood has an exceedence probability of 0.010. It was determined that, with 51 years of record, the probability of a flood this rare being exceeded is 40 percent. Since this risk is so high and it is known that several floods as large and possibly larger than the 1933 flood have historically occurred, the 1933 flood (and any smaller floods) was not considered to be a high outlier.

d. Historical accounts indicate that tides have occurred in Norfolk Harbor at approximately 8 feet in 1667 and 1785 and approximately 7.9 feet in 1846. There has been a gradual rise in sea level over the investigated period of record at Norfolk Harbor. There was some question as to the amount of adjustment that should be made to the historical floods. To avoid overestimating the impact of the rise in sea level, the historical floods were increased by only 0.50 feet (approximately the same adjustment for the 1924 to 1942 period). The analysis based on a historical period of 312 years resulted in a slight move to the left of the upper portion of the frequency curve when compared to the systematic record. Since the adjustment was not very large and there is some question as to the reliability of the historical data, the COE adopted the computed statistics based on the 51 years of systematic record.

e. The lower portion of the statistical curve was adjusted with a partial duration analysis using plotting positions in accordance with Weibull (Reference 4). It included all elevations above 4.26 feet.

f. Tidal elevations were correlated between the Gloucester Point, Lewisetta, and Solomon's Island gages for Norfolk Harbor to determine estimated tidal heights for the Town of Urbanna.

The stillwater elevations for the 10-, 50-, 100-, and 500-year floods have been determined for the Rappahannock River pertinent to the Town of Urbanna and are shown in Table 1. The tidal frequency relationship represents the combined effect of both hurricanes and northeasters on tidal flooding and reflects the random probability of surges occurring coincident with the normal astronomical tide.

TABLE 1 - SUMMARY OF STILLWATER ELEVATIONS

FLOODING SOURCE AND LOCATION	ELEVATION (feet) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
RAPPAHANNOCK RIVER				
Entire shoreline within community	4.6	6.2	7.0	8.7

3.2 Hydraulic Analyses

Hydraulic analyses, considering storm characteristics and the shoreline and bathymetric characteristics of the flooding source studied, were carried out to provide estimates of the elevations of floods of the selected recurrence intervals along each of the shoreline.

Special consideration was given to the vulnerability of the Town of Urbanna to wave attack. The inclusion of wave heights, which is the distance from the trough to the crest of the wave, increases the water-surface elevation. The height of a wave is dependent upon wind speed and its duration, depth of water, and length of fetch. The wave crest elevation is the sum of the stillwater elevation and the portion of the wave height above the stillwater elevation.

Areas of coastline subject to significant wave attack are referred to as coastal high hazard zones. The COE has established the 3-foot breaking wave as the criterion for identifying the limit of coastal high hazard zones (Reference 5). The 3-foot wave has been determined as the minimum size wave capable of causing major damage to conventional wood frame and brick veneer structures.

Based on the above criteria, the coastline of Urbanna is not exposed to severe wave attack and has not been designated as part of a Coastal High Hazard Zone.

All elevations are referenced to the National Geodetic Vertical Datum of 1929 (NGVD). Elevation reference marks used in this study are shown on the maps (Exhibit 1); the descriptions of the marks are presented in Elevation Reference Marks (Exhibit 2).

4.0 FLOODPLAIN MANAGEMENT APPLICATIONS

The NFIP encourages State and local governments to adopt sound floodplain management programs. Therefore, each Flood Insurance Study provides100-year flood elevations and delineations of the 100- and 500-year floodplain boundaries and 100-year floodway to assist communities in developing floodplain management measures.

4.1 Floodplain Boundaries

To provide a national standard without regional discrimination, the 1 percent annual chance (100-year) flood has been adopted by FEMA as the base flood for floodplain management purposes. The 0.2 percent annual chance (500-year) flood is employed to indicate additional areas of flood risk in the community. For tidal areas without wave action, the 100-year and 500-year boundaries were delineated using topographic maps at a scale of 1:24,000 with contour intervals of 5 and 10 feet (Reference 6).

The 100- and 500-year floodplain boundaries are shown on the Flood Insurance Rate Map (Exhibit 1). On this map, the 100-year floodplain boundary corresponds to the boundary of the areas of special flood hazards (Zone AE), and the 500-year floodplain boundary corresponds to the boundary of areas of moderate flood hazards. In cases where the 100- and 500-year floodplain boundaries are close together, only the 100-year floodplain boundary has been shown. Small areas within the floodplain boundaries may lie above the flood elevations but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data.

5.0 INSURANCE APPLICATION

For flood insurance rating purposes, flood insurance zone designations are assigned to a community based on the results of the engineering analyses. These zones are as follows:

Zone A

Zone A is the flood insurance rate zone that corresponds to the 100-year floodplains that are determined in the Flood Insurance Study by approximate methods. Because detailed hydraulic analyses are not performed for such areas, no base flood elevations or depths are shown within this zone.

Zone AE

Zone AE is the flood insurance rate zone that corresponds to the 100-year floodplains that are determined in the Flood Insurance Study by detailed methods. In most instances, whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone AH

Zone AH is the flood insurance rate zone that corresponds to the areas of 100-year shallow flooding (usually areas of ponding) where average depths are between 1 and 3 feet. Whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone AO

Zone AO is the flood insurance rate zone that corresponds to the areas of 100-year shallow flooding (usually sheet flow on sloping terrain) where average depths are between 1 and 3 feet. Average whole-foot depths derived from the detailed hydraulic analyses are shown within this zone.

Zone A99

Zone A99 is the flood insurance rate zone that corresponds to areas of the 100-year floodplain that will be protected by a Federal flood protection system where construction has reached specified statutory milestones. No base flood elevations or depths are shown within this zone.

Zone V

Zone V is the flood insurance rate zone that corresponds to the 100-year coastal floodplains that have additional hazards associated with storm waves. Because approximate hydraulic analyses are performed for such areas, no base flood elevations are shown within this zone.

Zone VE

Zone VE is the flood insurance rate zone that corresponds to the 100-year coastal floodplains that have additional hazards associated with storm waves. Whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone X

Zone X is the flood insurance rate zone that corresponds to areas outside the 500-year floodplain, areas within the 500-year floodplain, and to areas of 100-year flooding where average depths are less than 1 foot, areas of 100-year flooding where the contributing drainage area is less than 1 square mile, and areas protected from the 100-year flood by levees. No base flood elevations or depths are shown within this zone.

Zone D

Zone D is the flood insurance rate zone that corresponds to unstudied areas where flood hazards are undetermined, but possible.

6.0 FLOOD INSURANCE RATE MAP

The Flood Insurance Rate Map is designed for flood insurance and floodplain management applications.

For flood insurance applications, the map designates flood insurance rate zones as described in Section 5.0 and, in the 100-year floodplains that were studied by detailed methods, shows selected whole-foot base flood elevations or average depths. Insurance agents use the zones and base flood elevations in conjunction with information on structures and their contents to assign premium rates for flood insurance policies.

For floodplain management applications, the map shows by tints, screens, and symbols, the 100- and 500-year floodplains. Floodways and the locations of selected cross sections used in the hydraulic analyses and floodway computations are shown where applicable.

7.0 OTHER STUDIES

A search was made for existing literature on the flood hazards in Middlesex County. In 1978, the Virginia Institute of Marine Science (VIMS), under contract to FEMA, prepared a storm surge model for predicting storm surges along the Chesapeake Bay, both eastern and western shores (References 7 and 8). Consideration was given to these frequency studies, but they were not adopted in this report. An evaluation of the data led to conclusions that the elevations should be higher than presented.

A Flood Insurance Study for the unincorporated areas of Middlesex County is currently being prepared (Reference 9). The results of that study will be in exact agreement with the results of this study.

8.0 LOCATION OF DATA

Information concerning the pertinent data used in preparation of this study can be obtained by contacting the Natural and Technological Hazards Division, FEMA, Liberty Square Building (Second Floor), 105 South Seventh Street, Philadelphia, Pennsylvania 19106.

9.0 BIBLIOGRAPHY AND REFERENCES

1. Commonwealth of Virginia, Division of State Planning and Community Affairs, Data Summary-Middlesex County, Richmond, Virginia, March 1975.

2. U. S. Army Corps of Engineers, House Document 350, 88th Congress, 2nd Session, Tidewater Portions of the Patuxent, Potomac, and Rappahannock Rivers Including Adjacent Chesapeake Bay Shoreline-Interim Hurricane Survey, 1964.

3. Commonwealth of Virginia, Virginia Uniform Statewide Building Code, Article 8, Part C, Section 872.6, September 1973.

4. U. S. Department of the Interior, Geological Survey, Office of Water Data Collection, Interagency Advisory Committee on Water Data, "Guidelines for Determining Flood Flow Frequency," Bulletin 17B, Reston, Virginia, Revised September 1981.

5. U. S. Army Corps of Engineers, Galveston District, General Guidelines for Identifying Coastal High Hazard Zones, Galveston, Texas, 1975.

6. U. S. Department of the Interior, Geological Survey, 7.5-Minute Series, Scale 1:24,000, Contour Intervals 5 and 10 Feet: Urbanna, Virginia, 1968.

7. Virginia Institute of Marine Science, Volume I, Storm Surge Height-Frequency Analysis and Model Prediction for Chesapeake Bay, Gloucester Point, Virginia, June 1978.

8. Virginia Institute of Marine Science, Volume II, A Finite Element Storm Surge Analysis and its Application to a Bay-Ocean System, Gloucester Point, Virginia, September 1978.

9. Federal Emergency Management Agency, Flood Insurance Study, Unincorporated Areas of Middlesex County, Virginia (Unpublished).

EXHIBIT 2 - ELEVATION REFERENCE MARKS

Reference Mark	Elevation (Feet NGVD)	Description of Location
RM 1	26.838	USGS disk stamped 31 1916 RESET 1956 set in top of north abutment of State Route 227 bridge over Urbanna Creek, 18 feet west of centerline of State Route 227.